

WHAT IS CLAIMED IS:

1. A syringe for use in a medical injection procedure in connection with a connector having a tapered fitting, the syringe comprising:

a syringe tip comprising a cooperating tapered fitting having a passage therein in fluid communication with an interior of the syringe;

a first connecting member comprising a radially inward threaded portion on an inner surface thereof adapted to connect to a first type of connector comprising a tapered fitting and having at least one radially outward extending flange to connect to the radially inward threaded portion of the first connecting member; and

a second connecting member comprising at least one abutment member to connect to a second type of connector comprising a cooperating tapered fitting and a cooperating attachment member comprising at least one radially inward projecting flange to engage the at least one abutment member of the second connecting member.

2. The syringe of Claim 1 wherein the second connecting member comprises a threaded flange.

3. The syringe of Claim 1 wherein the first connecting member is positioned on a radial interior side of a generally cylindrical member surrounding the cooperating tapered fitting and the second connecting member is positioned on a radial exterior side of the generally cylindrical member.

4. The syringe of Claim 3 wherein the cooperating tapered fitting is a male luer fitting.

5. The syringe of Claim 4 wherein the second connecting member comprises at least one radially outward extending flange.

6. The syringe of Claim 4 wherein the second connecting member comprises at least one radially inward extending channel.

7. The syringe of Claim 3 wherein the second connecting member comprises a plurality of radially outward extending flanges.

8. A syringe and connector system for use in a medical injection procedure, the syringe and connector system comprising:

a syringe comprising a syringe tip on a forward end of the syringe, the syringe tip comprising a tapered fitting having a passage therein in fluid communication with an interior of the syringe, the syringe further comprising a first connecting member comprising at least one abutment member to connect to a connector comprising a cooperating tapered fitting and a cooperating attachment member comprising at least one radially inward projecting flange to engage the at least one abutment member of the first connecting member, the syringe further comprising a second connecting member having a radially inward threaded portion on an inner surface thereof adapted to connect to a tapered connector having a cooperating tapered fitting and at least one radially outward extending flange adapted to connect to the radially inward threaded portion of the second connecting member; and

a connector comprising a cooperating tapered fitting, a cooperating attachment member comprising at least one radially inward projecting flange to engage the abutment member of the first connecting member, and at least one port in fluid connection with the cooperating tapered fitting.

9. The syringe and connector system of Claim 8 wherein the abutment member comprises a single radially outward extending flange oriented generally perpendicular to an axis of the syringe tip.

10. The syringe and connector system of Claim 8 wherein the abutment member comprises a single radially inward extending channel oriented generally perpendicular to an axis of the syringe tip.

11. The syringe and connector system of Claim 8 wherein the abutment member comprises radially outward extending threading and the radially inward projecting

flange of the connector comprises a threaded portion to engage the threading of the attachment member.

12. The syringe and connector system of Claim 11 wherein the threaded portion of the connector is rotatable relative to the cooperating tapered fitting.

13. The syringe and connector system of Claim 8 wherein the cooperating attachment member of the connector comprises at least one extending arm comprising at least one radially inward extending flange.

14. The syringe and connector system of Claim 8 wherein the cooperating attachment member of the connector comprises a plurality of extending arms, each of the arms comprising at least one radially inward extending flange.

15. The syringe and connector system of Claim 14 wherein the radially inward extending flanges of the arms are biased radially inward when the connector and the syringe are engaged.

16. The syringe and connector system of Claim 15 wherein the arms are resilient, flexing arms and are biased radially inward by a bending moment.

17. The syringe and connector system of Claim 15 wherein the arms are biased radially inward by a locking member attached to the connector.

18. The syringe and connector system of Claim 14 wherein the connector further comprises a biasing member to provide axially oriented force directed to retain the tapered fitting of the syringe and the cooperating tapered fitting of the connector in sealing engagement.

19. The syringe and connector system of Claim 18 wherein the biasing member comprises at least one resilient spring arm in operative connection with the cooperating tapered fitting.

20. The syringe and connector system of Claim 18 wherein the biasing member comprises a plurality of resilient spring arms in operative connection with the cooperating tapered fitting.

21. The syringe and connector system of Claim 11 wherein the cooperating attachment member of the connector comprises a plurality of resilient, extending arms, each of the arms comprising a radially inward extending flange having at least one groove formed thereon to mate with the threading of the attachment member.

22. The syringe and connector system of Claim 21 wherein the arms are biased radially inward by a bending moment when the syringe and the connector are connected.

23. The syringe and connector system of Claim 22 wherein the connector is rotatable relative to the syringe after connection thereto to provide axially oriented force directed to retain the tapered fitting of the syringe and the cooperating tapered fitting of the connector in sealing engagement.

24. The syringe and connector system of Claim 23 wherein the arms prevent over tightening during rotation of the connector by flexing radial outward during rotation to slip over the threading of the attachment member.

25. The syringe and connector system of Claim 8 wherein the cooperating attachment member of the connector comprises at least one radially inward extending flange having an adjustable angle of orientation, the flange having a locking orientation in which it resists disengagement from the abutment member and a disengagement orientation in which the flange can pass over the abutment member of the syringe to be placed in engagement with or to be removed from engagement with the abutment member of the syringe.

26. The syringe and connector system of Claim 25 wherein the locking orientation forms a first angle with respect to the axis of the syringe tip, and the disengagement orientation forms a second angle with respect to the axis of the syringe tip, the second angle being closer to perpendicular to the axis of the syringe tip than the first angle.

27. The syringe and connector system of Claim 8 further comprising a deformable seal to form a seal between the tapered fitting and the cooperating tapered fitting.

28. A connector for use with a tapered fitting assembly having at least one attachment member, the connector comprising:

a cooperating tapered fitting;

at least one port in fluid connection with the cooperating tapered fitting; and

a cooperating attachment member attached to the cooperating fitting to engage the attachment member of the tapered fitting assembly, a predetermined level of force being required to cause the cooperating attaching elements to form a cooperating connection with the at least one attachment member of the tapered fitting assembly.

29. The connector of Claim 28 wherein the cooperating attachment member engages the attachment member via relative axial motion of the cooperating tapered fitting and the fitting assembly.

30. The connector of Claim 28 wherein the cooperating attachment member engages the attachment member via relative axial motion of the cooperating attachment member and the fitting assembly followed by rotation of the cooperating attachment member relative to the fitting assembly.

31. The connector of Claim 30 wherein the cooperating attachment is rotated no more than 90°.

32. The connector of Claim 28 wherein the cooperating attachment member comprises at least one axially extending arm having at least one radially inward extending flange projecting therefrom.

33. The connector of Claim 28 wherein the cooperating attachment member comprises a plurality of extending arms, each of the arms having at least one radially inward extending flange projecting therefrom

34. The connector of Claim 33 the flanges of the arms are biased radially inward in connection with the attachment member of the tapered fitting assembly when the connector and the fitting assembly are engaged.

35. The connector of Claim 34 wherein the arms are resilient, flexing arms and are biased radially inward by a bending moment.

36. The connector of Claim 34 wherein the arms are biased radially inward by a locking member attached to the connector.

37. The connector of Claim 33 wherein the connector further comprises a biasing member to provide axially oriented force directed to retain the tapered fitting assembly and the cooperating tapered fitting of the connector in sealing engagement.

38. The connector of Claim 37 wherein the biasing member comprises at least one resilient spring arm in operating connection with the cooperating tapered fitting.

39. The connector of Claim 37 wherein the biasing member comprises a plurality of resilient spring arms in operating connection with the cooperating tapered fitting.

40. The connector of Claim 33 wherein each of the plurality extending arms is flexible and resilient and each of the radially inward extending flanges of the extending arms comprises at least one groove to mate with threading of the attachment member of the tapered fitting assembly.

41. The connector of Claim 40 wherein the arms are biased radially inward by a bending moment when the syringe and the connector are connected.

42. The connector of Claim 41 wherein the connector is rotatable relative to the tapered fitting assembly after connection thereto to provide axially oriented force directed to retain the tapered fitting assembly and the cooperating tapered fitting of the connector in sealing engagement.

43. The connector of Claim 42 wherein the arms prevent over tightening during rotation of the connector by flexing radial outward during rotation to slip over the threading of the attachment member.

44. A connector for use with a tapered fitting assembly, the connector comprising:

a cooperating tapered fitting;

a cooperating attachment member in operative attachment with the cooperating fitting to engage the tapered fitting assembly; and

at least one port in fluid connection with the cooperating tapered fitting; the cooperating attachment member comprising a radially inwardly extending flange having an adjustable angle of orientation, the flange having a locking orientation in which it resists disengagement from the tapered fitting assembly and a disengagement orientation in which the flange can be placed in engagement with the tapered fitting assembly or be removed from engagement with the tapered fitting assembly.

45. The connector of Claim 44 wherein the locking orientation forms a first angle with respect to the axis of the syringe tip, and the disengagement orientation forms a second angle with respect to the axis of the syringe tip, the second angle being closer to perpendicular to the axis of the syringe tip than the first angle.

46. A connector for use with a tapered fitting assembly having at least one attachment member, the connector comprising:

a cooperating tapered fitting; and

a plurality of resilient, extending arms in operative attachment with the cooperating tapered fitting, each of the arms comprising at least one radially inward extending flange, a predetermined level of force being required to cause the radially inward extending flanges to form a cooperating connection with the at least one attachment member of the tapered fitting assembly.

47. The connector of Claim 46 wherein a rearward surface of the radially inward extending flanges of the arms is sloped forward to cause the arms to flex radially outward when the connector is moved to contact the radially inward extending flanges of the arms with the attachment member of the tapered fitting assembly which comprises a radially outward extending flange.

48. The connector of Claim 47, further comprising a biasing member in operative connection with the cooperating tapered fitting to provide an axial force directed to maintain the tapered fitting assembly and the connector in engagement when the connector is engaged to the tapered fitting assembly.

49. The connector of Claim 46, further comprising a retainer to attach a length of tubing thereto by contacting the exterior wall of the tubing.

50. The connector of Claim 46, further comprising a valve connected to the port.

51. The connector of Claim 50 wherein the valve is a check valve.

52. An injector system for use in a medical injection procedure, the injector system comprising:

a powered injector comprising a drive member;

a syringe comprising an engagement mechanism for removable attachment of the syringe to the injector, a plunger adapted to cooperate with the drive member of the injector, and a syringe tip on a forward end of the syringe, the syringe tip comprising a tapered fitting having a passage therein in fluid communication with an interior of the syringe, the syringe further comprising a first connecting member having at least one attachment member; and

a connector comprising a cooperating tapered fitting, a cooperating attachment member to engage the attachment member of the first connecting member, and at least one port in fluid connection with the cooperating tapered fitting, a predetermined level of force

being require to cause the cooperating attachment member to form a connection with the at least one attachment member of the first connecting member.

53. A connector for use with a tapered fitting assembly having at least one attachment member, the connector comprising:

a cooperating tapered fitting;

a cooperating attachment member operable to engage the attachment member of the tapered fitting assembly; and

at least one port in fluid connection with the cooperating tapered fitting; the cooperating attachment member comprising a plurality of extending arms, each of the arms comprising at least one radially inward extending attaching element, the connector further comprising a biasing member to provide axially oriented force directed to retain the tapered fitting assembly and the cooperating tapered fitting of the connector in sealing engagement.

54. The connector of Claim 53 wherein the biasing member comprises at least one spring arm in operative connection with the cooperating tapered fitting.

55. The connector of Claim 53 wherein the connector is formed from an integral piece of resilient polymeric material.

56. The connector of Claim 54 wherein the connector is formed from an integral piece of resilient polymeric material.

57. A method for fabricating a connector for use with a tapered fitting assembly having at least one attachment member, the method comprising the step of forming the connector from an integral piece of polymeric material, the connector being formed to include a cooperating tapered fitting, a cooperating attachment member to engage the attachment member of the tapered fitting assembly, and at least one port in fluid connection with the cooperating tapered fitting; the cooperating attachment member comprising a plurality of extending arms, each of the arms having at least one radially inward extending attaching element, the connector further comprising a biasing member to provide axially

oriented force directed to retain the tapered fitting assembly and the cooperating tapered fitting of the connector in sealing engagement.

58. The method of Claim 57 wherein the biasing member comprises at least one spring arm attached to the cooperating tapered fitting.

59. A method of connecting a connector comprising a tapered fitting with a tapered fitting assembly comprising a cooperating tapered fitting, the method comprising the steps of forming an axial compressive force directed to maintain connection between the tapered fitting of the connector and the cooperating tapered fitting of the tapered fitting assembly under pressure, and indicating to the user that the axial compressive force has been attained.

60. The method of Claim 59, further comprising the step of engaging radially inward extending flanges of extending, resilient arms of the connector with at least one abutment member of the tapered fitting assembly, the radially inward extending flanges being biased radially inward to engage the abutment member of the tapered fitting assembly.

61. An adapter for use in a medical injection procedure in connection with connectors having a tapered fitting, the adapter comprising:

a forward portion comprising a tapered fitting;

a surface surrounding at least a portion of the male tapered fitting, the surface comprising at least one attachment member to connect to a connector comprising a female tapered fitting and a cooperating attachment member to engage the at least one attachment member; and

a rearward portion comprising a rearward fitting in fluid connection with the male tapered fitting.

62. The adapter of Claim 61 wherein the forward fitting is a male luer fitting and the rearward fitting is a female luer fitting.

63. The adapter of Claim 61 wherein the surface comprises a radially inward threaded portion on an inner surface thereof.

64. The adapter of Claim 61 wherein the male tapered fitting, the female tapered fitting and the surface of the adapter are formed integrally.

65. The adapter of Claim 64 wherein the adapter is formed of a molded polymeric material.

66. An adapter and connector system for use in a medical injection procedure, the system comprising:

an adapter comprising a forward portion having a male tapered fitting, a surface surrounding at least a portion of the male tapered fitting, the surface comprising at least one attachment member; and a rearward portion comprising a rearward fitting in fluid connection with the male tapered fitting; and

a connector comprising a female tapered fitting to engage the male tapered fitting of the adapter, a cooperating attachment member to engage the at least one attachment member of the adapter, and at least one port in fluid connection with the female tapered fitting.

67. The system of Claim 66 wherein the surface comprises a radially inward threaded portion on an inner surface thereof.

68. The system of Claim 66 wherein rearward fitting is a female luer fitting and the attachment member of the adapter comprises an abutment surface to form a connection with at least one radially inward extending flange of the cooperating attachment member.

69. The system of Claim 66 wherein the attachment member comprises a single flange oriented generally perpendicular to an axis of the adapter.

70. The system of Claim 66 wherein the attachment member comprises radially outward extending threading and the cooperating attachment member of the connector comprises a threaded portion to engage the threading of the attachment member.

71. The system of Claim 70 wherein the threaded portion of the connector is rotatable relative to the cooperating tapered fitting.

72. A connector for use in a medical procedure to connect to a fitting assembly comprising an interference fitting, comprising: a cooperating interference fitting and an indicator to inform the user that the interference fitting of the fitting assembly and the cooperating interference fitting of the connector have been brought together with an axial compressive force suitable to maintain sealed connection between the tapered fitting of the connector and the cooperating tapered fitting of the tapered fitting assembly under a known pressure.

73. The connector of Claim 72 wherein the indicator comprises an attachment member on the connector that comes into connection with a cooperating attachment member on the fitting assembly, the connection resisting axial disconnection of the connector from the fitting assembly.

74. The connector of Claim 73 wherein the attachment member on the connector comprises at least one axially extending, flexible arm comprising a radially inward projecting abutment member to connect to the cooperating attachment member.

75. The connector of Claim 74 wherein the interference fitting of the fitting assembly is a tapered fitting and the cooperating interference fitting of the connector is a cooperating tapered fitting.

76. The connector of Claim 75 wherein the tapered fitting of the fitting assembly is a luer fitting and the tapered fitting of the connector is a cooperating luer fitting.

77. The connector of Claim 72 wherein at least one of the interference fitting of the fitting assembly and the cooperating interference fitting of the connector comprises a deformable surface to improve sealed connection therebetween.

78. The connector of Claim 72 wherein an axial compressive force is maintained between the interference fitting of the fitting assembly and the cooperating interference fitting of the connector while connected.

79. A connector for use in a medical procedure to connect to a fitting assembly comprising a fitting and an attachment member, comprising: a cooperating fitting comprising an annular deformable seal, a port in fluid connection with the cooperating fitting, and a cooperating attachment member, the cooperating attachment member cooperating with the attachment member to maintain the connector in connection with the fitting assembly so that the deformable seal maintains a sealed connection with the fitting of the fitting assembly.

80. The connector of Claim 79 wherein the annular seal in fluid contact with a fluid flowing through the connector and a force with which the annular seal contacts the fitting of the fitting assembly increases with increasing fluid pressure.

81. A connector for connection to a male fitting assembly comprising a surface surrounding a male fitting, the connector comprising a length of deformable conduit, the end of the deformable conduit comprising a radially outward extending flange dimensioned to form a sealed connection with the surrounding surface.

82. The connector of Claim 81 wherein the surrounding surface of the male fitting assembly comprises radially inward extending threading, the flange of the deformable conduit abutting the threading to prevent disconnection of the connector from the male fitting assembly when under fluid pressure.

83. The connector of Claim 82 wherein the male fitting is a male luer fitting.

84. A connector for connection to a male fitting assembly comprising a male fitting, the connector comprising a length of deformable conduit and a slidable collet surrounding the conduit, the conduit is dimensioned to form a sealed connection between the male fitting and the deformable conduit when the deformable conduit is connected to the male fitting and the collet is slid thereover.

85. The connector of Claim 84 wherein the male fitting assembly comprises a generally cylindrical surface surrounding the male fitting, the conduit dimensioned to slide between the deformable conduit and generally cylindrical surface.

86. A connector comprising:

a male fitting assembly comprising a male interference fitting and a generally cylindrical barrel surrounding the male fitting, the barrel having at least one pitched flange positioned adjacent a generally axially oriented slot on the interior wall thereof; and

5 a female fitting assembly comprising a female interference fitting and at least one radially outward projection dimensioned to pass through the slot of the male fitting assembly and be rotated into abutment with the at least one pitched flange.

87. The connector of Claim 86 wherein the male fitting assembly comprises two generally axially oriented slots positioned generally opposite of each other, a first plurality of pitched flanges between the slots on one side of the interior of the barrel and a second plurality of pitched flanges between the slots on another side of the interior of the barrel.

10 15 88. The connector of Claim 87 wherein the female fitting assembly comprises two radially outward projections, each projection dimensioned to pass through one of the slots of the male fitting assembly and be rotated into abutment with one of the pitched flanges.

89. The connector of Claim 88 wherein the female member comprises a stop member to stop rotation of the female fitting assembly after a predetermine amount of rotation.

90. The connector of Claim 88 wherein the rotation required to form a
5 sealed connection between the female fitting and the male fitting is no more than 90°.